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TECHNIQUES AND PRACTICES OF RESOURCE EFFICIENT PRODUCTION



KYIV, 2015



ABOUT EaP GREEN PROGRAMME

The "Greening Economies in the European Union's Eastern Partnership Countries" (EaP GREEN) programme assists six countries of the European Union Eastern Neighbourhood in progressing faster towards a green economy. Decoupling economic growth from environmental degradation should result in higher productivity and competitiveness, better natural capital management, enhanced environmental quality of life and achieved sustainability in the economy.

EaP GREEN is financially supported by European Commission and jointly implemented by four international organizations OECD, UNEP, UNECE, and UNIDO. Additional support is provided by other countries, including Austria, Norway, Switzerland, and the Netherlands.

EaP GREEN responds to commitments made by countries, the European Union and other partners in major international forums including the Rio+20 Earth Summit.

ABOUT RESOURCE EFFICIENT AND CLEANER PRODUCTION (RECP)

Global concept UNIDO and UNEP "Resource efficient and cleaner production" provides comprehensive, strategic and consistent basis for strengthening and widespreading continuous implementation of preventive environmental strategy to processes, products and services to increase efficiency and reduce risks for humans and the environment.

The Primer is designed for the awareness raising of small and medium-sized enterprises in Ukraine about the principles and practices of RECP implementation. Terminology used in the Primer is adapted into Ukrainian for defining the objectives, problems, steps and advantages of RECP.



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INTRODUCTION

READ THIS PRIMER AND MAKE YOUR BUSINESS BETTER

Small and medium-sized enterprises are one of the leading sectors in the market economy. Recently the number of such enterprises in Ukraine has increased. According to Ukrainian State Committee of Statistics, in 2014 they comprised 99 % from total amount of the enterprises. Small and medium-sized business provides approximately 15 % of Gross Domestic Product in Ukraine. Among all SMEs, more than a half is concerned with trade and public catering, approximately 14 % are industrial output producers, and 10 % are representatives of construction industry. Manufacturing activity of SMEs is mainly concentrated in such sectors of industry as food, chemical, textile, machine-building sectors, construction materials production sector etc.

Any industrial enterprise has a negative impact on the environment and as a result has economic loss. Although single SME's environmental impact can be insignificant, the total pollution, including emissions into the atmosphere, waste water and waste generation, is quite significant and needs urgent actions for its minimization.

BETTER ENVIRONMENTAL INDICATORS OF THE ENTERPRISE –
ARE ITS COMPETITIVE ADVANTAGES.

One of the mechanisms of SMEs' negative environmental impact minimization is using such a managerial approach at the enterprises that will allow increasing efficiency of resources consumption and pollution reduction without the decreasing of the income, or even with its increasing. Better environmental indicators of the enterprise are its competitive advantages.

Resource Efficient and Cleaner Production (RECP) Concept is a complex consecutive preventive environmental strategy used in the industrial processes for increasing economic efficiency of the enterprise, decreasing of production risks for the personnel, and decreasing of environmental exposure.

At the enterprises RECP implies reduction of raw materials, water and energy consumption, diversion of toxic materials usage, as well as decreasing of the volume and toxicity of all waste and emissions. Due to its universal principles RECP is comprehensive and accessible, having no strict limitations for its implementation at SMEs of all industrial sectors.

This Primer reveals the contents, notions and main principles of the RECP. Also it highlights key stages of implementation in production activities and shows the examples of best practices of RECP implementation at the enterprises. The objective of this primer is presenting the RECP benefits and opportunities for stimulation of its implementation among SMEs in Ukraine and increasing of production efficiency and companies' competitiveness.

I

COMPETITIVE BUSINESS: BENEFITS OF RECP

RECP IS SEARCHING THE WAYS TO SUSTAINABLE PRODUCTION AND CONSUMPTION

With the development of industry and appreciable impacts from environmental pollution, the human attitude to the nature was gradually changing. Searching the ways of solving topical problems and receiving positive effect in the direction of sustainable production and consumption was made continuously.

In the evolution of approaches to environmental management and environmental protection, the following stages could be defined:

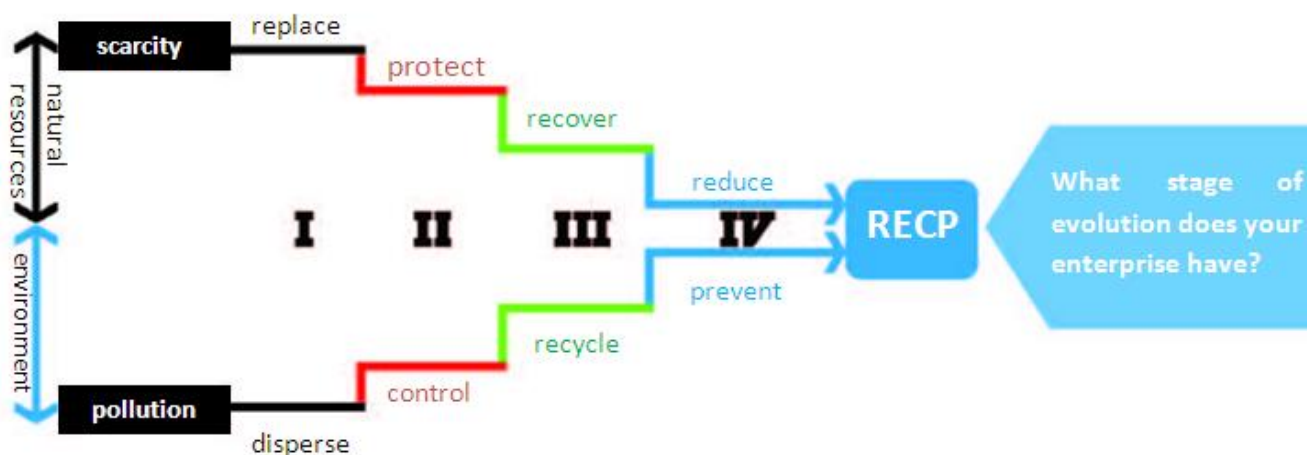
I stage: The problem of natural resource **depletion** and **pollution** was solved by **replacing** the source of the same resource and **dispersion** (building of high flue pipes for extraction of burning products into the atmosphere and waste disposal into the large rivers and seas, far away from the coastline).

II stage: The activity was aimed at protection of natural resources (forests, rivers, lakes, and land resources) and controlling the amount of waste disposal by means of using cleansing equipment, so-called "end-of-pipe" technology.

III stage: **Recovering** of natural resources and **recycling** (waste reuse as a raw material).

IV stage: Increasing production efficiency, **decreasing** of volumes of natural resources consumption and **prevention** of waste and emissions generation.

EVOLUTION OF APPROACHES TO ENVIRONMENTAL MANAGEMENT



The combination of approaches of the last phase formed the RECP concept that offers a method of finding a balance between environmental impact and economic stability of the company.

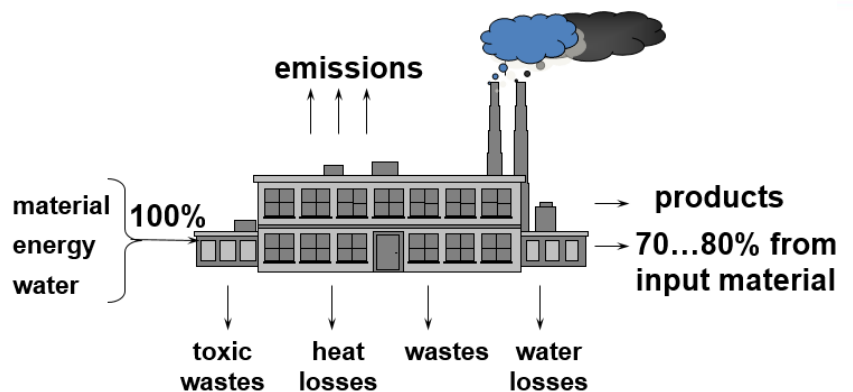
RECP ALLOWS FINDING A BALANCE BETWEEN ENVIRONMENTAL
IMPACT AND ECONOMIC STABILITY OF THE ENTERPRISE.

Most industrial enterprises of Ukraine have outdated equipment and facilities and use outdated technologies, when their capacity implies huge volumes of production that cannot be realized in today's market conditions. Usage of such technologies causes overconsumption of raw materials, fuel, energy resources that increases the cost of product and increases environmental exposure.

A NEW LEVEL OF RESOURCE EFFICIENCY AND COMPETITIVENESS.

RECP implementation at the enterprise allows observing the situation, potential and ways of saving due to efficient resources consumption and decreasing of product cost, as well as reduction the amount of waste generation and emissions into the atmosphere, increasing the resource efficiency and competitiveness.

Combining environmental efficiency of production with economic growth of the enterprise is the main idea of resource efficient and cleaner production (RECP).



WHAT BENEFITS WILL YOUR BUSINESS GET BY IMPLEMENTING THE RECP?

	1. COST SAVING
	2. PRODUCT INCREASE
	3. PRODUCT QUALITY
	4. ORGANIZATIONAL EFFICIENCY
	5. LICENSE-TO-OPERATE

More detailed information about all the benefits you will find next.

COST SAVING

RECP provides the set of steps aimed at saving materials, energy and water that immediately influences the cost for the unit of production and environmental compliance, which in turn promotes decreasing of costs for waste disposal and pollution fine.

Cost saving is accumulation or saving of monetary resources by means of more efficient energy consumption, rational materials and water consumption and reduction of wastes and emissions generation.





Do you have savings due to efficient energy and materials consumption?

BEST PRACTICES:

Due to the RECP measures enterprise located in Kyiv and specialized in production of construction materials with production capacity is 58 000 m³/year, managed to have savings that are reflected in the table "Economic benefits":



MEASURES

			
Maintenance and good housekeeping of pipeline (low-cost measures)	Implementation of automatic system for commercial accounting of power consumption, installation of frequency controllers, implementation of reactive power compensation system	Maintenance and replacement of equipment for cement transportation	Usage of heat generators

ECONOMIC BENEFITS

Measures	Investments [€]	Savings [€/year]	Savings per year
	500	550	1 200 m ³ of water
	65 000	62 800	740 MWh + 1 005Mvarh of reactive power
	74 000	102 700	1 730 t of cement
	46 000	153 000	460 000 m ³ of gas
SAVINGS:		319 050 €/year	

PRODUCT INCREASE

Productivity can be considered as a general indicator of resource efficiency. Product increase can be achieved through effective management of production process, which can reduce prime costs, energy consumption, water consumption and using materials at the enterprise.

Product Increase is reduction of specific resource consumption indicator for manufacturing of one product unit.

Is there potential for increasing productivity at your enterprise?






BEST PRACTICES:

Company, located in Kiev, produces and sells a wide range of reinforced concrete products, ready-mix concrete and solutions for industrial and individual building.

Increasing of productivity is achieved by application of RECP methods and can be shown in the following directions:

PRODUCTIVITY GROWTH (in % per year)

ENERGY	WATER	MATERIALS
		
+62 %	+19 %	+7 %

PRODUCT QUALITY

Selection of sources of raw materials, more efficient use of materials and replacement of toxic components improve the quality of the products and can increase demand and expand the market. Moreover, high-quality products can reduce the environmental exposure, because it has a longer life cycle and service period.

Product quality is a range of technical and ecological features of ready-made product, which specify its ability to meet consumer's needs.

Do you want to increase
the quality of your
products?

BEST PRACTICES:

The enterprise is located in Kharkiv and is producing mineral-wool slabs of nonorganic fibrous materials got from silicate melt of basalt rock. With implementation RECP methods, the company managed to increase product quality.

Thus, the analysis of technical process of the enterprise revealed the low level of production possibilities regarding product range. This perspective is related to the characteristics of the polymerization chamber. It was suggested that the modernization or replacement of polymerization chamber that led to the expansion of product range by manufacturing the final product with different characteristics, can solve marketing problems, especially in the complex and public procurement and increase overall profits by 5-6%.



ORGANIZATIONAL EFFICIENCY

According to the concept of RECP, organizational efficiency is the providing guidelines and motivation of company employees to continuous improvement and increasing production efficiency.





In order to receive better results and generate efficient ideas team work and interest of workers of all levels are needed.

Among the means for personnel motivation rising could be:

- ➔ acceptance by the management of new thoughts and ideas;
- ➔ system of bonuses;
- ➔ awareness about environment protection necessity;
- ➔ providing advanced training;
- ➔ creating sound working conditions.

Organizational efficiency is an ability of the enterprise to exist and reach defined goals with the most profitable correlation of results and expenditures.

What measures does your company use to increase the level of organizational efficiency?

How would you rate your company's performance in regard to management of each of the following:				
Resource use				
Use of raw materials		+		
Use of energy		+		
Use of water			+	
Use of chemicals			+	
Environmental impact				
Disposal of waste				+
Discharge of air emissions				+
Discharge of waste water				+
Control over toxic substances			+	
Odour		+		
Noise				+
Company performance				
Management commitment, including environmental policy		+		
Production efficiency, including level of technology			+	
Employee motivation, including environmental awareness		+		
Workplace conditions				+
Working procedures				+
Legal compliance; business and social responsibility				
Compliance with applicable environmental legislation			+	
Corrective actions imposed by authorities (environmental permits)		+		
Feedback from community			+	
Feedback from clients and suppliers				+

BEST PRACTICES:

Periodical questioning of the company employees about situation assessment by the workers of different levels gives the opportunity to define the problems and start searching the corresponding decisions.

LICENSE-TO-OPERATE

Public relations and market position is an integral component for the effective functioning of the enterprise. Meeting the needs of the consumers, social responsibility and compliance with legislative regulations build a firm foundation for creating positive image of the enterprise on national and international levels, state support, extension of product markets and product competitiveness, increasing of consumer confidence.

License-to-operate is acceptance or support of the company's activity by the society, market, state, neighbor enterprises, which implies taking care of product quality and well-being of people.

How does your enterprise increase the level of social creditability?

BEST PRACTICES:

Enterprise producing sunflower oil has declared reduction of the impact on the environment and human health, improved product characteristics and confirmed it with the international environmental certificate. Labelling the products that had environmental certification according to the standard of ISO 14024 is recognized in 60 countries worldwide, including EU and the USA. These products correspond to high quality standards, which is key to the consumer confidence.



II

CLEANER ENVIRONMENT: SOLVING ISSUES

WHAT PROBLEMS DOES RESOURCE EFFICIENT AND CLEANER PRODUCTION SOLVE?

Production of any product is not waste-free and, in one or another way, causes damage to the environment. Waste and emissions generation cannot be avoided even using the most up-to-date technological processes.

The actual problems for the enterprises are quality of materials, water and heat loss, excessive energy, excessive generation of waste and sewage, lack of control of emissions into the atmosphere. Complex solving of current issues by means of implementation of RECP provides the maximum benefit for the environment and business.



SOLVING PRODUCTION ISSUES BY IMPLEMENTATION OF RECP PROVIDES THE MAXIMUM BENEFIT FOR ENVIRONMENT AND BUSINESS

RECP identifies the following six areas of issue solving:

	1. SELECTION AND EFFICIENT USE OF MATERIALS
	2. SUPPLY SOURCES AND EFFICIENT WATER CONSUMPTION
	3. EFFICIENT ENERGY CONSUMPTION
	4. REDUCTION AND SAFE WASTE DISPOSAL
	5. REDUCTION AND TREATMENT OF WASTE WATER
	6. REDUCTION AND CONTROL OF AIR EMISSIONS

What issues are relevant to your enterprise?

More detailed information about motivation and typical decisions each of the issues you can find next.

SELECTION AND EFFICIENT USE OF MATERIALS

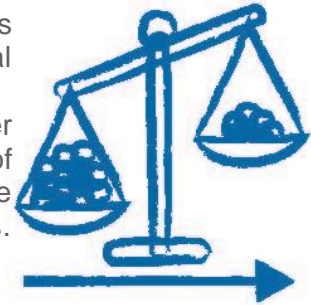
WHAT PROBLEMS WITH MATERIALS AT THE ENTERPRISES EXIST?

The quality and cost of raw materials used by the enterprises is decisive in the selection of the supply source.

In particular, the enterprise faces challenges of resources depletion, their territorial availability and logistics, environmental pollution as a result of their extraction.

Moreover, you must consider the complexity and power consumption of the primary materials processing, the possibilities of raw materials reusing, which play a significant role in the manufacturing of high-quality and economically attractive products.

Efficient usage of raw material with minimum waste generation leads to product increase.



Does your enterprise use secondary raw materials?

HOW CAN THE EFFICIENCY OF MATERIAL USAGE BE INCREASED?

Consideration of all above-mentioned factors will allow improving the productivity and environmental image of the enterprise by means of:






- optimal selection and change the raw materials with recyclable by-products from other industrial sectors;
- improving of logistics that will reduce air pollutions by cars;
- selection of materials that do not need any additional treatment and recycling will allow saving of energy and human resources;
- increasing product quality.

WHAT ARE THE TYPICAL SOLUTIONS THAT RECP OFFERS?

For efficient consumption and selection of materials the following can be done:

- well-organized input materials accounting and quality control at all stages of its usage;
- changing of raw material components for alternative and less toxic ones that will provide saving or improving the quality of ready-made product;
- using of wastes from other production as a raw material.



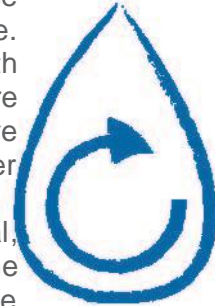
BEST PRACTICES:		
Object:		
	<p>Paperboard plant with production capacity approximately 70 mln m²/year is located in Ukrainka town.</p> <p>During the year the company processes over 160 mln m² of cardboard, 116 mln m² of paper, 780 t of starch, 70 t of flexography dye and 30 t of glue.</p>	
Defined problems:		
	<p>Huge volume of waste paper and overconsumption of gas and electricity, as well as overconsumption of dye and glue in the production process.</p>	
Measures:		
	<ul style="list-style-type: none"> • by means of changing more expensive corn starch for potato starch, the amount of additives was reduce by 3 t; • usage of additional aniloxes and laying equipment allowed reducing dye losses by 20 %; • usage of modified additives led to reduction of glue consumption by 20 %. 	
Economic benefits:		
	Investments [€]	Savings [€/year]
	150 500	485 300
Result:		
	<p>MATERIAL SAVINGS (PAPER, GLUE, DYE, ADDITIVES) ARE</p> <p>1 921,3 t/year.</p>	

SOURCING AND EFFICIENT USE OF WATER

WHAT ISSUES WITH WATER REQUIRES AN URGENT SOLUTION?

Water is used by the enterprise as raw material, as heat-transfer agent for heating system, for washing equipment and vehicles, for sanitary and household needs etc. Quite often the enterprise management consider this resource as inexhaustible and cheap one. Thus, such approach is wrong. Availability and quality of water, both technological and drinking, is worsening all the time and its tariffs are raising. The enterprises that are operating for more than 30 years have outdated pipeline systems, breaks in which cause significant water losses.

The situation with water resources in Ukraine is almost critical, because pollution of groundwater and surface water increases. The question of necessity in water saving, river and lakes protection is quite topical nowadays.



WHAT MOTIVATES THE ENTERPRISE TO SAVE WATER?

Saving water consumption and maintenance of water systems in proper conditions will allow the enterprise:

- ➔ cutting the losses;
- ➔ defining the opportunities of water recycling, which will positively affect economic aspect of the enterprise;
- ➔ decreasing the price for water consumption and waste water disposal etc.



What quantity of water does your enterprise consume?

WHAT ARE THE TYPICAL SOLUTIONS THAT RECP OFFERS?

Measures that will promote efficient water consumption are:

- ➔ installation of meters at each production stage;
- ➔ keeping of pipelines and sanitary equipment in appropriate conditions;
- ➔ providing of instructing trainings for the personnel about saving water consumption;
- ➔ installation of automotive water clippers;
- ➔ implementation systems of automotive equipment cleaning;
- ➔ installation of water recirculation system;
- ➔ implementation the arrangement of rainwater collectors.



BEST PRACTICES:		
Object:		
	<p>Campus of the largest university in Kyiv, Ukraine. Totally, the university has 21 265 students, 851 postgraduate students, 33 doctor's degree applicants and 7 638 employees.</p>	
Defined problems:		
	<p>Overconsumption of water, unsatisfactory conditions of pipelines and sanitary equipment.</p>	
Measures:		
	<ul style="list-style-type: none"> • maintenance / replacement of pipelines; • meters installation; • installation of pressure regulators at general input pipelines and their arrangement; • organizational / educational measures about water consumption for increasing environmental culture of students. 	
Economic benefits:		
	Investments [€]	Savings [€/year]
	83 920	35 344
Result:		
	<p>WATER SAVINGS ARE</p> <p>151 936 m³/year</p>	

SELECTION AND EFFICIENT USE OF ENERGY

WHAT PROBLEMS WITH ENERGY CONSUMPTION ARE TYPICAL FOR THE ENTERPRISES?

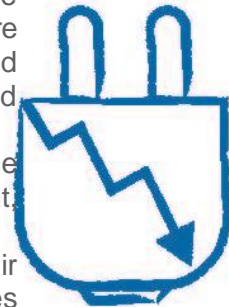
Typically, expenditures on energy sources for the enterprise are an essential part of production costs. The main energy resources are natural gas, fuel (diesel and petrol), fossil fuels (coal, coke) and electricity. Among alternative energy sources there are solar, wind and hydropower, bioenergy (brackets, pellets, and biogas) and others.

Considering rising prices for fuel and electricity in Ukraine, the issue of energy efficiency is becoming more urgent and important, especially for SMEs.

Outdated equipment with excess capacity, compressed air leakages through broken pipelines, default heat insulation of pipelines and production buildings lead to huge overconsumption of energy resources.

At the same time, modernization and replacement of equipment for modern and energy efficient one always needs huge investments that it not acceptable and available for all the enterprises.

Therefore, minimization of heat and energy losses can be achieved by effective energy management and usage of alternative energy sources.



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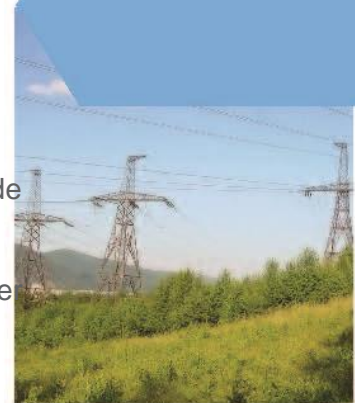
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WHAT EFFECT DOES ECONOMIC ENERGY CONSUMPTION GIVES?

Measures on reduction of energy consumption usually provide the biggest economic effect, especially:

- ➔ reduction of the cost for energy resources;
- ➔ reduction of the amount of CO₂ emissions and other greenhouse gases;
- ➔ reduction of the level of energy dependence, etc.

Is your equipment energy efficient?



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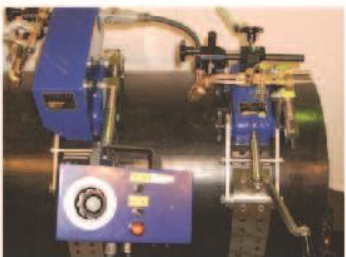


WHAT ARE THE TYPICAL SOLUTIONS THAT RECP OFFERS?

The range of technical decisions that allow saving of energy resources is quite wide:

- ➔ installation sensors for lighting;
- ➔ installation of automotive production systems;
- ➔ installation meters of energy and heat;
- ➔ buildings and equipment thermal modernization;
- ➔ changing of working mode;
- ➔ using alternative types of fuels;
- ➔ partial or full replacement of technical equipment line for modern and energy saving one.

I



BEST PRACTICES:		
Object:		
	<p>The enterprise manufactures gas-cutting equipment and is located in Vinnytsia.</p> <p>The company produces boilers, gas and gas-welding equipment for machine building and metal processing industries. Total amount of metal production is 140 t per year.</p>	
Defined problems:		
	<p>Scarce electricity control at the production areas, overconsumption of natural gas, obsolete and energy intensive technological equipment.</p>	
Measures:		
	<ul style="list-style-type: none"> • installation of automatic system for commercial accounting of power consumption; • installation of solid fuel boiler of own production; • replacement of natural gas to pellets; • modernization of technological line with installation of energy saving gas-cutting equipment. 	
Economic benefits:		
	Investments [€]	Savings [€/year]
	169 500	59 600
Result:		
	<p>ELECTRICITY SAVINGS ARE</p> <p>1 185 MWh/year.</p>	

REDUCTION AND SAFE WASTE DISPOSAL

WHAT PROBLEMS AS A RESULT OF WASTE GENERATION OCCUR?

Industrial waste comprise up to 94% of the total waste generated by the enterprises in Ukraine, 0.3% of which are dangerous waste. The main part of waste comes from mining industry. Among the enterprises of processing industry the largest volumes of waste generated and accumulated are from metallurgical, chemical and food industries. The problem of waste is one of the most topical questions of environmental security and sustainable development.

The excessive waste generation also leads to economic losses at the enterprises, as waste is a lost resource for the enterprise, because it is the result of processing of input raw materials.



What is the real cost of waste at your enterprise?

WHAT DOES THE ENTERPRISE RECEIVE FROM THE REDUCTION AND RECYCLING OF WASTE?

Efficient and save waste management in production process will allow the enterprise:






- ➔ reducing the cost for its storage, transportation and utilization;
- ➔ increasing enterprise's productivity;
- ➔ reduction of the product cost etc.

WHAT ARE THE TYPICAL SOLUTIONS THAT RECP OFFERS?

RECP suggests the following steps for improvement of environmental situation at your enterprise:

- ➔ implementing recycling of waste generated from production of ready-made product;
- ➔ preliminary waste sorting, and production of useful and economic attractive product from waste remains;
- ➔ installation of waste recycling equipment.



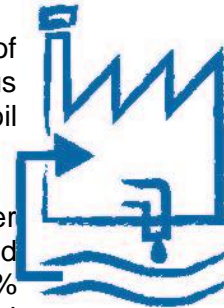
BEST PRACTICES:		
Object:		
	<p>Cloth factory, located in Bohuslav. The factory produces wool and semi-wool fabrics, some clothes and uniform. Annually the company produces 700 000 m² of woollen fabrics by consuming 411 t of materials.</p>	
Defined problems:		
	<p>Accumulation of waste dust from cloth production.</p>	
Measures:		
	<ul style="list-style-type: none"> dust from cloth production (approximately 30 t/year) is dehydrogenated remains of plants organics and can be used as a fuel for heat generation burnt in the boiler at the enterprise. 	
Economic benefits:		
	Investments [€]	Savings [€/year]
	0	2 584
Result:		
	<p>WASTE REDUCTION BY</p> <p>30 t/year.</p>	

REDUCTION AND TREATMENT OF WASTE WATER

WHAT PROBLEMS WITH WASTE WATER AT ENTERPRISE EXIST?

The effect of using huge amount of water resources for production needs by industrial enterprises is generation of three kinds of waste water, such as household, surface and industrial waste water.

The main sources of surface water contamination is disposal of household and industrial waste water that content hazardous substances, surface flow from enterprise territories, as well as soil erosion from surface runoff territory (surface sewage flow).



According to the results of summarizing data on state audit of water consumption, approximately 8 000 mln m³ of waste water are discharged annually in Ukraine, 60 % of which are from industrial enterprises, 25 % from housing and communal services and 15 % from agricultural enterprises. Contaminated water comprises 20 % of total amount of waste water.

Today in Ukraine the payment for waste water disposal by the enterprises is very low, but the tariffs are rising.

important is awareness about the responsibility for water contamination and real defining of volume of waste water of definite type, its possible reduction and water treatment.

WHAT IS THE EFFECT OF REDUCTION OF THE VOLUME AND TREATMENT OF WASTE WATER FOR THE ENTERPRISE?

Reduction of amount of waste water disposal, as well as decrease in concentration of hazardous chemicals in waste water, will allow the enterprise:

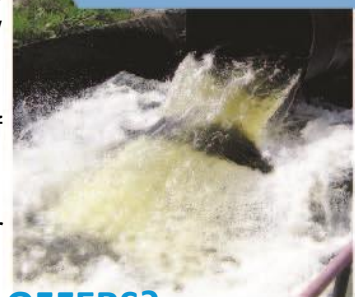
- ➔ reducing the fees for polluted waste water discharge;
- ➔ bringing the significant contribution to the improvement of general ecological situation in Ukraine;
- ➔ promoting improvement of health of the society;
- ➔ saving one of the most important natural resources for future generations.

WHAT ARE THE TYPICAL SOLUTIONS THAT RECP OFFERS?

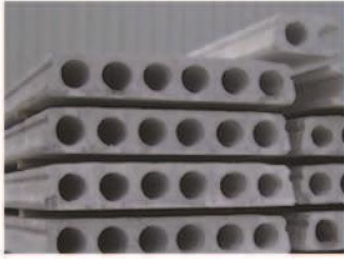




Among measures that RECP recommends for reduction the number of waste water there are:

- ➔ controlling consumption of drinking water for household and industrial needs by means of well-timed and organizational decisions and removing of leakages;
- ➔ specifying some waste water sewers as household, technological and other ones with different level of contamination;
- ➔ replacement of technological processes for reduction of water consumption;
- ➔ condensate collection and its recuperation in technological process;
- ➔ arranging of secondary water treatment systems and installation of the reciprocal water supply systems.

How much waste water does your company discharge?





BEST PRACTICES:		
Object:		
	The enterprise is located in Kyiv and produces reinforced concrete constructions, slag blocks and expanded clay concrete blocks.	
Defined problems:		
	Inappropriate conditions of sanitary equipment, inefficient monitoring of water consumption at the enterprise.	
Measures:		
	<ul style="list-style-type: none"> • monitoring of water consumption for household needs; • maintaining appropriate conditions of sanitary equipment. <p>By means of water management measures (monitoring of water consumption and maintaining appropriate conditions of sanitary equipment), the enterprise reduced amount of waste water by 28 % per year.</p>	
Economic benefits:		
	Investments [€]	Savings [€/year]
	5 641	4 480
Result:		
	<p style="text-align: center;">REDUCTION OF WASTE WATER BY</p> <p style="text-align: center;">287 m³/year</p>	

REDUCTION AND CONTROL OF AIR EMISSIONS

WHAT PROBLEMS WITH AIR EMISSIONS ARE RELEVANT FOR ENTERPRISES?

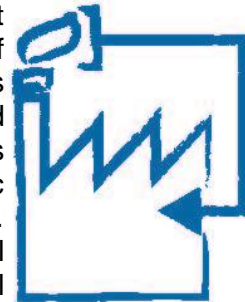
The main sources of air pollution are industrial enterprises, heat and power stations and transport. Due to imperfection of technological processes, gases with different toxic gaseous components, vapour of organic substances, fine-dyspersated inclusion and additives come the atmosphere. Greenhouse gases (GHG) such as water vapour, carbon dioxide, methane, ozone, nitric oxide and chlorofluorocarbon impose a significantly negative impact.

One of main contamination process for the environment is fuel burning in heat and power engineering. While burning of 1 kg of coal 2.3 kg of CO₂ are emitted, and under the burning of 1 m³ of natural gas 1.9 kg of CO₂ are emitted.

Electricity consumption also has indirect impact on the amount of CO₂ emissions into the atmosphere, as its generation needs fuel burning.

In addition to the negative impact on the air, emissions cause in-plant harmfulness at the enterprise - the conditions of the working environment, labour and manufacturing processes that affect the health of workers, leading to illness and reduced labour productivity.

Every enterprise is responsible for hazardous emissions into the atmosphere during production process. The government have to stimulate the enterprise to reduce emissions and control the limits of air emissions by means of paying fine for overstepping the indicator.



WHY IS IT GOOD FOR THE ENTERPRISE TO CONTROL AND REDUCE AIR EMISSIONS?

Reduction of hazardous substances and GHG emissions will allow the enterprise:

- improving the air condition;
- reducing the payment for emissions;
- improving the image of the enterprise by increasing ecological characteristics of production;
- decreasing energy resources consumption;
- providing health working conditions.

Do you know the real amount of emissions at your enterprise?



WHAT ARE THE TYPICAL SOLUTIONS THAT RECP OFFERS?

Reduction of the amount of CO₂ and other substances emissions into the atmosphere can be gained by means of:

- reduction of energy consumption;
- modernization of technological process;
- modern gas-cleaning plants;
- energy efficient equipment with less amount of CO₂ emissions.

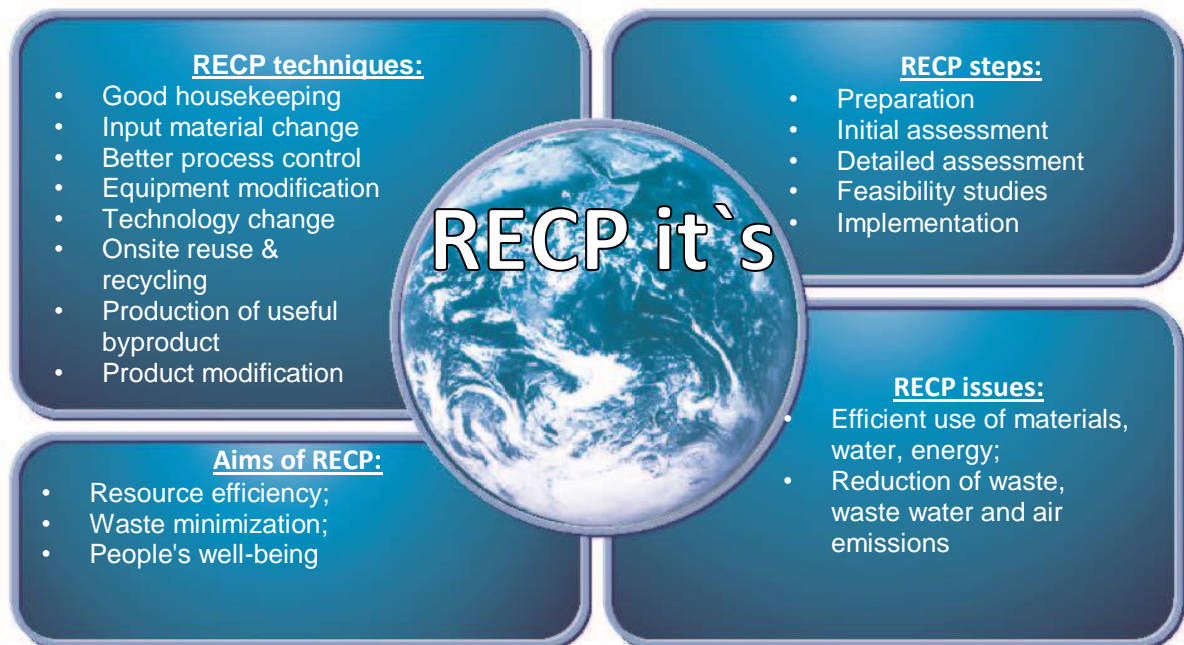


BEST PRACTICES:		
Object:		
	<p>Company is specialized on glass manufacturing, located in Zaporizhzhia. Total volume of production is over 47 000 t per year.</p>	
Defined problems:		
	<p>Huge heat losses through fettling and extra air coming to the oven through untighten furnace roof. Insufficient slam utilization, heat losses with flue gases and insufficient control over water temperature and pressure.</p>	
Measures:		
	<ul style="list-style-type: none"> • partial modernization of furnace roof; • drying of charge mixture and products by flue gases; utilization and reuse of slam; • reduction of amount of products sent for remelting; • usage of heat from flue gases will save 24 000 m³ of gas, 400 MWh of electricity and reduce greenhouse gases emissions by 170 t of CO₂ per year. 	
Economic benefits:		
	Investments [€]	Savings [€/year]
	210 448	72 093
Result:		
	<p>REDUCTION OF GHG EMISSIONS IS</p> <p>170 t/year.</p>	

III

WAYS OF REALIZATION: RECP TECHNIQUES

RECP implementation is possible for every enterprise that is manufacturing or providing some services, no matter which sector or production capacity it has. RECP methodology may be applied on regular basis with continuous improvement of received results.




MAIN OBJECTIVES OF RECP ARE:

- 1. Resource efficiency**, which characterizes dependence of amount of resources used in the production process and amount of produced items and services, which also implies reaching full usage of resources of the enterprise
- 2. Waste minimization** implies development and introducing measures and technological solutions that allow reduction of waste generation and their wide reuse as raw materials and energy sources, as well as using of closed cycle technology and waste-free processes.
- 3. People's well-being** as providing for the population all the necessary material needs and compliance with economic and social security requirements (clean environment, better working conditions etc.)



STEPS OF RECP IMPLEMENTATION

For successful RECP implementation, there are five consecutive steps:

- 
- **Preparation** – first visit to the enterprise for getting basic information and overview of the company;
 - **Initial Assessment** – assessment of the enterprise, including defining general state of production activity of the company and collection information about consumption of energy sources, materials, water, generation of waste, sewage water and hazardous substances;
 - **Detailed Assessment** – assessment of the enterprise for defining drawbacks of the technological process and searching for sources of problems and ways of their solving;
 - **Feasibility Studies** – studying the possibilities and benefits of implementation of resource and energy saving measures and increasing indicators of enterprise efficiency, taking into consideration the technological process, investments, saving and payback period of proposed options
 - **Implementation** – practical realization of operations and technological options for improvement of resource efficiency.

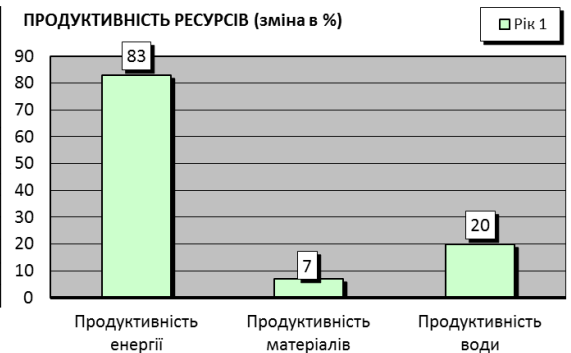
CONTINUOUS IMPROVEMENT OF RECP IS SUSTAINABLE AND EFFICIENT OPERATION OF THE ENTERPRISE.

Consecutive and detailed implementation of each of these steps allows realizing RECP cycle with continuous improvement for receiving the best results for sustainable and efficient operation of the enterprise.

ВІДНОСНІ РЕЧВ ПОКАЗНИКИ

Показник	Одиниці вимірювання	Базовий показник (В) (Перед впровадженням РЕЧВ)	Рік 1 А (Після впровадження РЕЧВ)	Зміни © С= 100*(А-В)/В [%]
Продуктивність ресурсів				
Продуктивність енергії	П на кВт*год енергії	0,00328157	0,00622547	89,71
Продуктивність матеріалів	П на тону матеріалів	0,47057878	0,58974934	25,32
Продуктивність води		2,78672673	3,88275700	39,33
Інтенсивність забруднення				
Інтенсивність CO2	тон CO ₂ -екв на П	0,13781083	0,09762362	-29,16
Інтенсивність стоків	м3 стоків на П	0,23635812	0,19172700	-18,88
Інтенсивність відходів	тон відходів на П	0,03975692	0,02834997	-28,69

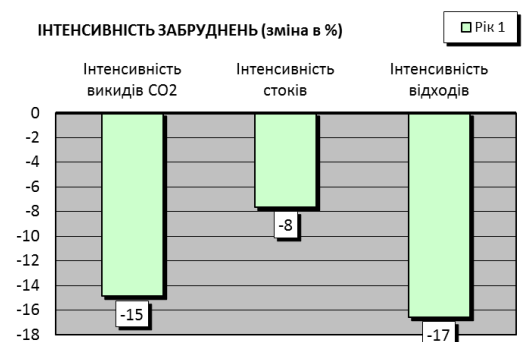
ПРОДУКТИВНІСТЬ РЕСУРСІВ (зміна в %)



АБСОЛЮТНІ РЕЧВ ПОКАЗНИКИ

ПОКАЗНИК	Одиниці вимірювання	Базовий показник (В) (Перед впровадженням РЕЧВ)	Рік 1 А (Після впровадження РЕЧВ)	Зміни (С) С=100*(А-В)/В [%]	Різниця між А и В
Використання ресурсів					
Використання енергії	[кВт*год/рік]	13 337 620,00	8 226 270,00	-38,32	-5 111 350,00
Використання матеріалів	[тон/рік]	93 009,57	86 837,57	-6,64	-6 172,00
Використання води	[м3/рік]	15 706,00	13 189,70	-16,02	-2 516,30
Забруднення					
Двоокис вуглецю	[тон CO ₂ -екв/рік]	6 031,75	4 999,54	-17,11	-1 032,21
Відходи води (стоки)	[м3/рік]	10 345,00	9 818,80	-5,09	-526,20
Відходи води	[тон/рік]	1 740,09	1 451,87	-16,56	-288,22
Випуск продукції					
Випуск продукції: П	м3/рік]	43 768,33	51 212,40	17,01	7 444,07

ІНТЕНСИВНІСТЬ ЗАБРУДНЕНЬ (зміна в %)





IMPLEMENTATION OF RECP AT THE ENTERPRISE:



KEY TECHNIQUES, THROUGH WHICH THE OBJECTIVES OF RECP ARE ACHIEVED:

1. GOOD HOUSEKEEPING
2. INPUT MATERIAL CHANGE
3. BETTER PROCESS CONTROL
4. EQUIPMENT MODIFICATION
5. TECHNOLOGY CHANGE
6. ONSITE REUSE & RECYCLING
7. PRODUCTION OF USEFUL BYPRODUCT
8. PRODUCT MODIFICATION



More than 40 enterprises in Ukraine have successful experience of using these techniques.



Good housekeeping is taking regular measures and actions aimed at providing household activities of the enterprise, which are concerned to on-going premises maintenance, keeping of working condition of equipment, and providing of appropriate working environment for the personnel.

WIDESPREAD DECISIONS

- ➔ Pipelines maintenance;
- ➔ Systematic maintenance of equipment;
- ➔ Regular inventorying;
- ➔ Checking of storage premises;
- ➔ Regular instructing trainings at the working place;
- ➔ Clean and tidy working place of employees.



BEST PRACTICES:

The enterprise, located in Vinnytsia, and producing lock and seal valves, took such good housekeeping measures, as automatic switching off the shower, installation of sprinkles and limiter for water consumption for the showers, and systems of double flush in toilet tanks. Such measures annually will save for the enterprise 1 800 m³ of water and approximately 4 000 m³ of gas used previously for water heating.

Input material change is the process of changing input materials and resources with reusing of other materials or using less hazardous or toxic substances during production process for reducing the amount of waste generation and improving its environmental characteristics.

WIDESPREAD DECISIONS

- ➔ using such input materials, waste of which can be reused;
- ➔ partial or full change of raw materials with better technological quality and availability;
- ➔ using renewable energy sources;
- ➔ recycling of resources.

BEST PRACTICES:

The example of input materials changing is at the enterprise of cardboard-cellulose industry sector, located in the Kyiv region. They replaced using PVA glue in the technological process for hot adhesive that led to advancement of conglutination process, increasing of strength and decreasing of the amount of defected production and waste.



Better process control is applying additional operations and measures for better quality of controlling of the technological indicators at all production stages.

WIDESPREAD DECISIONS

- ➔ automation of technological process;
- ➔ installation of controlling and measuring devices at all production stages;
- ➔ energy resources audit;
- ➔ installation of automatic system for commercial accounting of power consumption.



BEST PRACTICES:

As an example of applying of better process control technique is the enterprise producing plastic devices for medical purposes, located in Bilhorod-Dnistrovskiyi. They installed the meters and introduced distributive audit at all production stages that allows reducing total energy consumption by approximately 5 %.

Equipment modification is the process of continuous improvement, modernization and renewal of technological base of the enterprise for getting better levels of production capacity.

WIDESPREAD DECISIONS

- automation and mechanization of production process;
- adjustment of production line;
- replacement of outdated and life-expired equipment;
- complex renewal of equipment pool.

BEST PRACTICES:

The company producing and maintaining railway cars in Kyiv made equipment modification by means of replacement of gas-cutting devices for modern plasma cutting equipment. This decision led to reduction of energy resources consumption (104 000 m³ of gas), as well as reducing of time for metal processing and reducing of the amount of metal and oxygen usage (891 t of O₂).



Technology change is replacement of the way of processing and conversion of input materials (materials, energy, water etc.) at different stages of production process without worsening of final product quality.

WIDESPREAD DECISIONS

- ➔ production technology change;
- ➔ automation of technological process;
- ➔ replacement of the equipment used for technological process in production.



BEST PRACTICES:

The replacement of gas burners in ovens with pellet burners at the bread-baking plant in Vinnytsia is an example of applying of technology change principle. Gained savings will be over 40 000 m³/year of gas for the enterprise with payback period of 0.7 year.

ONSITE REUSE AND RECYCLING

Onsite reuse and recycling is applying of technological operations related to changing of waste features for its on-site utilization or its recycling in the technological process.

WIDESPREAD DECISIONS

- ➔ heat regeneration;
- ➔ water recuperation;
- ➔ condensate usage;
- ➔ production waste recycling.

BEST PRACTICES:

The company from machine building sector (producing component parts for railway company “Ukrzaliznytsia”) in Vinnytsia is a successful example of the principle of onsite reuse and recycling. They extracted the aluminium out of slum that is accumulated on cleansing plants and is transported for reusing as coagulating agent.



Production of useful byproduct is the process of getting byproduct or material out of remains and waste from main material waste, which is commercially attractive for other consumers.

WIDESPREAD DECISIONS

- using production remains as energy resources;
- commercial usage of production remains;
- production from production remains for realization.



BEST PRACTICES:

The example of production of useful byproducts is usage of residues at the sugar factory as a fuel for biogas system. Additional byproduct during biogas production at the enterprise is production of, organic manure that is sold to local farmers.



PRODUCT MODIFICATION

TECHNIQUE

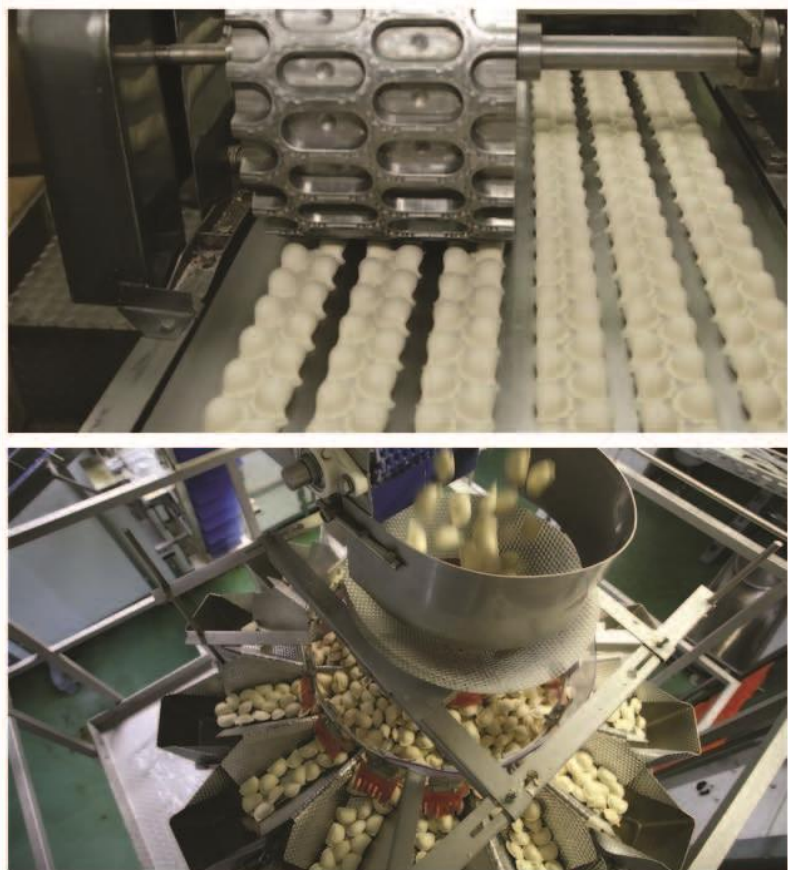
Product modification is partial changes in products that are manufactured, including the change of external appearance, size, and improvement of product characteristics or prolonging its lifecycle, improvement utilization ways and reduction of environmental impact.

WIDESPREAD DECISIONS

- change in external appearance of ready-made product for reduction of production waste generation;
- change of packing type and prolonging of its lifespan;
- searching for optimal appearance for the product for realization.

BEST PRACTICES:

The enterprise producing semi-finished products, dumplings, located in Odessa region, implemented the principle of product modification by means of replacement of standard dough forming matrix for a compact one. This option will allow increasing of amount of dough parts by 25 %, reducing electricity consumption by 56 %, and reducing production waste.



CONCLUSIONS

LET'S TRY TO USE YOUR RESOURCE EFFICIENCY POTENTIAL!

Application of techniques and practices of RECP will give your company the opportunity to:

- ➔ increase production efficiency during the crisis in Ukraine;
- ➔ reduce raw materials and energy resources consumption;
- ➔ reduce enterprise exposure on the environment;
- ➔ bring closer to international quality standards for production processes and products;
- ➔ increase credibility level among society and government;
- ➔ improve the image of enterprise;
- ➔ increase the competitiveness at the national and international markets.

RECP implementation promotes sustainable industrial development in Ukraine.



EFFICIENT PRODUCTION IS YOUR SUSTAINABLE FUTURE!!!



TERMINOLOGY

The primer is using adapted terminology for explanation of the objectives, challenges, stages and principles of implementation of RECP for the enterprises of Ukraine adding original terms in English.

Resource Efficient and Cleaner Production (RECP) Concept is a complex consecutive preventive environmental strategy used in the industrial processes for increasing economic efficiency of the enterprise, decreasing of production risks for the personnel, and decreasing of environmental exposure. At the enterprises, RECP implies reduction of raw materials, water and energy consumption, diversion of toxic materials usage, as well as decreasing of the volume and toxicity of all waste and emissions.

Benefits of RECP

Cost saving is accumulation or saving of monetary resources by means of more efficient energy consumption, rational materials and water consumption and reduction of wastes and emissions generation.

Product Increase is reduction of specific resource consumption indicator for manufacturing of one product unit.

Product quality is a range of technical and ecological features of ready-made product, which specify its ability to meet consumer's needs.

Organizational efficiency is an ability of the enterprise to exist and reach defined goals with the most profitable correlation of results and expenditures

License-to-operate is acceptance or support of the company's activity by the society, market, state, neighbor enterprises, which implies taking care of product quality and well-being of people.

RECP issues

Selection and efficient use of materials is a process of selection and supply of raw materials due to its local availability, logistics, quality of raw materials and the environmental pollution resulting from their extraction.

Sourcing and efficient use of water is providing the enterprise with high-quality water with minimal expenditures and its productive usage with less amount.

Selection and efficient use of energy is using less energy to provide the appropriate level of energy supply for technological processes in the production and effective functioning of the enterprise in general.

Reduction and safe disposal of waste is provision of environmental waste treatment for reuse for the needs of the enterprise, or purchasing it and implementation of measures to reduce waste generation.

Reduction and treatment of waste water is activities aimed to reduce consumption and pollution of the water by the enterprise with the subsequent neutralization of wastewater and bringing water to its original condition.

Reduction and control of air emissions is reducing the maximum allowable concentration (MAC) of harmful emissions into the atmosphere and compliance of the technological process of the enterprise with environmental requirements.



RECP techniques

Good housekeeping is taking regular measures and actions aimed at providing household activities of the enterprise, which are concerned to on-going premises maintenance, keeping of working condition of equipment, and providing of appropriate working environment for the personnel.

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Implementation – practical realization of operations and technological options for improvement of resource efficiency.

REFERENCES

- UNIDO (2011). Green Industry Initiative for Sustainable Industrial Development.
[<http://apki.net/wp-content/uploads/2012/06/UNIDO-Green-Industry-Initiative-for-Sustainable-Industrial-Development.pdf>]
- UNIDO, UNEP (2010). Enterprise - Level Indicator for Resource Productivity and Pollution Intensity. A Primer for Small and Medium-Sized Enterprises.
[http://www.unep.fr/scp/cp/understanding/pdf/web_sme_indicator_primer.pdf]
- Державна служба статистики України. Статистична інформація.
[<http://www.ukrstat.gov.ua>]
- Центр ресурсоефективного та чистого виробництва в Україні (2015). Концепція РЕЧВ
[<http://recpc.kpi.ua/ua/pro-nas-2/kontseptsiya-rechv>]
- Центр ресурсоефективного та чистого виробництва в Україні (2015). Про програму Eap GREEN/
[<http://www.recpc.kpi.ua/ua/projects-ua/eap-green/>]
- Центр РЕЧВ в Україні (2015). Успішний досвід підвищення ресурсоефективності підприємств Вінницької та Київської областей.
[http://recpc.kpi.ua/images/materials/Katalog_Centr_NCPC_Final.pdf]
- UNIDO (2009). A Greener Footprint for Industry. Opportunities and Challenges of Sustainable Industrial Development.
[http://www.greenindustryplatform.org/wpcontent/uploads/2013/05/Green_Industry_Initiative.pdf]
- EaPGREEN (2015). Экологизация малых и средних предприятий: Пособие по инструментам природоохранной политики для стран Восточного партнерства ЕС
[<http://www.oecd.org/environment/outreach/Greening-SMEs-policy-manual-rus.pdf>]
- Міністерство екології та природних ресурсів України (2012). Національна доповідь про стан навколишнього природного середовища в Україні у 2012 році
[<http://www.menr.gov.ua/dopovidj>]
- Центр РЕЧВ в Україні (2010). Проект «Более чистое производство» в Запорожской и Винницкой регионах 2009-2010.
- Центр РЕЧВ в Україні (2012). Посібник з більш чистого виробництва. Частина 1-4.
- Центр РЕЧВ в Україні, UNIDO (2014). Впровадження ресурсоефективного та чистого виробництва на підприємствах України – 2014 (галузь виробництва будівельних матеріалів).
[http://recpc.kpi.ua/images/eap_green/leaflets/business%20case%2014%20ukr.pdf]



EXECUTORS OF DEMONSTRATION PROJECT 'RESOURCE EFFICIENT AND CLEANER PRODUCTION' WITHIN THE EAP GREEN PROGRAMME:

United Nations Industrial Development Organization

Address: Vienna International Centre, PO Box 300, A1400, Vienna, Austria.

Web page: www.unido.org/eapgreen
www.eap-green.org

Resource Efficient and Cleaner Production Centre (Ukraine)

Address: 37 Peremogy Ave., build 6, Kyiv, 03056, Ukraine.

Web page: www.recpc.kpi.ua
www.recpc.org